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ABSTRACT

This manual provides information needed to meet specific standards for certification as a pesticide applicator. Chapter one deals with the safety problems of pesticide use to humans, livestock and the environment. The second chapter is concerned with the types of application equipment and their utilization. Specific pests of livestock and poultry are covered in the last chapter. Information on description, life cycle, damage and control of flies, lice, and mites is provided. (CS)

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SUBCATEGORY
ANIMAL

SE 024 073

INSTRUCTIONS FOR USING THIS TRAINING MANUAL

This training manual is intended to provide you with the information you will need to meet the standards of the U. S. Environmental Protection Agency for commercial certification as a pesticide applicator in the subcategory Agricultural - Animal, and to prepare you to take an examination given by the pesticide regulatory agency based on this manual. It is not intended that this manual or training will provide you with all the information that you need for effective pest control. Up-to-date information regarding recommended materials and methods should be obtained from your Cooperative Extension office, your state extension publications and the label.

The manual is designed for use as a self-study manual by individuals, or it may be used in conjunction with other training materials at training schools. Your core manual (either the Northeast or EPA-USDA core training manual) is the basic information manual for all pesticide applicators. This manual begins where the core manual left off. Refer back to your core manual as necessary.

This manual was developed to be used in an open book exam since it contains resource information that is not intended for memorization. It will require careful study so that you are sufficiently familiar with its contents that needed information can be quickly found and used within the period allowed for examination.

Practice study questions are also enclosed to help you study and to familiarize you with the general type of questions that may be asked.

You should place this manual in the same binder with your Northeast Core Manual or with the core manual you used for certification at the core level to qualify you for category certification.

PESTICIDE APPLICATOR TRAINING MANUAL
CATEGORY 1
AGRICULTURAL

SUBCATEGORY - ANIMAL

A Training Program for the Certification
of Commercial Pesticide Applicators

Cooperative Extension
Chemicals-Pesticides Program
New York State College of Agriculture and Life Sciences
at
Cornell University, Ithaca, New York

October 1976

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INTRODUCTION

You have completed the core training of pesticide certification and now are about to start additional training for your commercial application. This manual will cover information in the commercial category - Agricultural (Animal). You will be responsible for the general information that appears in Chapters I, II, and III, along with the specific information that pertains to your category training.

The purpose of this manual is to:

-- provide federal minimum category standards for certification

-- provide identity to some common problems in the use of pesticides

-- provide identity to some common pests

-- provide methods of calibration, maintenance and operation of equipment used in the application of pesticides in agriculture.

This manual focuses on principles which apply to your operations and which will enable you to improve your competency to use pesticides.

Standards for Certification

The Environmental Protection Agency has set minimum standards for certification of pesticide applicators. Among these standards is a section relating to your operations as a commercial applicator.

The specific standards from the Federal Register for this category of commercial applicators are as follows:

> "(ii) *Animal.* Applicators applying pesticides directly to animals must demonstrate practical knowledge of such animals and their associated pests. A practical knowledge is also required concerning specific pesticide toxicity and residue potential, since host animals will frequently be used for food. Further, the applicator must know the relative hazards associated with such factors as formulation, application techniques, age of animals, stress and extent of treatment."

A knowledge of the techniques and hazards associated with pesticide application to animal premises is also a necessity and is required in New York State.

You will need specific information for your local situation. Cooperative Extension and your industry organizations are sources for such information.

Responsibility for Certification

It is the Environmental Protection Agency's responsibility to see that minimum standards are met. A lead agency is designated in each state that is responsible to EPA for certification training and enforcement. The Department of Environmental Conservation is the lead agency for New York State. Within the agency the Bureau of Pesticides has all regulatory responsibilities dealing with pesticides, including making up and giving the examinations for certification and enforcing the requirements.

Cooperative Extension is responsible for training pesticide applicators in preparation for certification. The core level of training for both private and commercial applicators is offered in indivudal counties through the local Cooperative Extension field staff. Category training is offered by teams of specialists (mainly from Cornell), usually on a regional basis. All examinations are administered by a representative of DEC.

Animals and Pests

Commercial applicators must demonstrate practical knowledge of animal management and the specific pests of animals on which they may be using pesticides.

Your full and adequate knowledge of animals and pests for which you provide service is basic to performance of your work. You must:

-- accurately identify the pests

-- select the correct registered pesticides

-- determine the necessity of chemical control

-- apply the most effective and efficient control measures

With this knowledge, your ability to provide safe and effective service to your customers will be greater.

Concern for Others

Practical knowledge is required to recognize:

-- time interval between treatment and freshening or slaughter. Pre-freshening or preslaughter intervals are established to protect the consumer from harmful residues. It is your responsiblity to make sure that your customer is completely informed about these intervals.

-- potential contamination of water by your application of pesticides.

-- overdosage resulting in toxicity to treated animals.

Bad habits and sloppy practices can result in injury to treated animals or in environmental contamination and can be avoided or reduced by careful supervision and strict attention to approved methods and directions for use. Careless habits resulting in misuse, littering the landscape and contaminating the environment are not only prohibited by law, but contribute to bad public relations.

Your concern for the environment, including people who live, play, or work near your operations, is vital to your future.

I. PROBLEMS WITH PESTICIDE USE

Your core manual deals mostly with the acute hazards of pesticides to man and other warm blooded animals when handling highly toxic pesticides. As a commercial applicator you are daily exposed to many pesticides ranging from low to high toxicity. You must consider their total effect on yourself. You must also consider more closely than most private applicators the side effects of residues, tolerances, and overdosage. Your health and repeat business depends on your knowledge and care in application.

Hazards to the Applicator, Worker and Consumer

Dermal Toxicity to the Applicator

Most people take pains to avoid inhaling or ingesting pesticides. However, many people overlook the hazard of absorption through the skin. In one of our states using the largest number of pesticides, absorption through the skin was responsible for over 80% of the cases of poisoning from agricultural and industrial use of agricultural chemicals. This can occur as the result of a splash, spill, or drift when you and/or your help are mixing or applying the chemical, or from contact with a pesticide "deposit" or "residue" after it has been applied.

The hazard of skin absorption is increased by cuts, abrasions, scratches, scuffs, or other damage to the skin. However, absorption can occur rapidly even through healthy skin. Absorption is high and rapid in such areas as the scrotum, arm pit, ear canal, forehead and scalp. It is lower and slower in the palm of the hand, or ball of the foot. However, even in these lower absorption areas, penetration can be great and vary from material to material. Carbaryl (Sevin) for example, is thought of as a relatively safe material, but is absorbed through the skin of the forearm about 7 times more rapidly than parathion

or malathion. Whether highly toxic or relatively safe, any pesticide spilled or splashed on the skin should be washed off immediately. Studies show that pesticides can be absorbed within a few minutes. Waiting until a job is done before washing may be too late! Wash by rubbing the hands together or with a piece of cloth using detergent or soap. Do not scrub with a brush since the outer protective layer of the skin may be scratched enough to allow the pesticide to become absorbed through the skin. The hands should be protected with gloves when working on spray machinery. When using high pressure sprays or applying residual wall sprays, a wide-brimmed, waterproof hat, coveralls, and unlined rubber boots with the pant cuffs on the outside should be sufficient. Waterproof gloves should be worn if specified on the label. An extra pair of coveralls is very handy to have in case of accidental spray contamination.

Eyes

Eyes are particularly sensitive to harm by pesticides and should be protected with goggles or a face shield. If pesticide is splashed into the eye, immediately wash it with a gentle stream of clean running water while holding the eyelid open. A few seconds delay greatly increases the extent of injury. Large amounts of water should be used and continued for 15 minutes or more. Do not use chemicals or drugs in wash water. They may increase the injury. A convenient plastic eye wash bottle and holder is now available and might be useful. They can be purchased from chemical laboratory suppliers and are called "eye wash stations."

Lungs

Most applicators do not feel that inhalation of a pesticide is much of a hazard. However, it is next in importance to skin contact as a cause of agricultural accidents. Because the lungs have such a large and highly absorptive surface area, even small amounts of pesticide are hazardous because they are almost completely absorbed. Vapors and extremely fine particles, 10 microns or smaller, are a particular hazard. The use of whole body sprays or mist fog applications to animals in poorly ventilated stanchion barns must be approached with particular caution. Windows or doors should be opened when possible to provide ventilation and respirators should be worn as indicated on the label and under conditions you think such protection desirable. Occasional use of

most moderately toxic pesticides does not usually require use of a respirator. Daily use of these pesticides, however, or use in enclosed areas, greatly increases your exposure and may necessitate use of a respirator. It is also wise to wear a respirator when using moderately toxic pesticides like malathion during the same day or days you are also using other highly toxic pesticides of the same family.

Respirators and Gas Masks for Pesticides

All respirators intended for use with pesticides must be approved jointly by the Mining Enforcement and Safety Administration (MESA) and the National Institute of Occupational Safety and Health (NIOSH). Approval numbers beginning with the letters TC are assigned to all respirators approved by the agency. This number must be on the box containing the facepiece. Cartridges and filters approved for pesticides are necessary and must have the TC number affixed to them plus the part number of the replacement part. Chemical cartridge respirators approved for pesticides will have the code number 23C following the letters TC and gas masks will have the number 14G following TC. Respirators having numbers other than TC numbers (i.e., BM numbers) are no longer approved unless they can be upgraded to meet requirements through the use of appropriate cartridges and filters.

As of April 1, 1976, it is our understanding that the following respirators are approved for pesticide use under the new standards:

Standard Chemical Cartridge Respirators

-- MSA number 459520 respirator with 459519 cartridge. Approval number TC-23C-45. Mine Safety Appliances Co.

-- Willson AGRI-TOX-2 respirator. 1200 series respirator with R21 Chemical Cartridges, R15 filters and R683 filter retainers. Approval Number TC-23C-54. Willson Products Division, ESB, Inc.

-- Welsh 7549 respirator with 7500-21 cartridges and 7500-23 filters. Approval Number TC-23C-74. Welsh, A Textron Co.

-- MSA 448848 respirator with 448847 cartridges. Approval Number TC-23C-79. Mine Safety Appliances Co.

-- AO number R5058 or R6058 respirator with R58 cartridge. Approval Number TC-23C-106. Safety Products Division, American Optical Corp.

-- Pulmosan Number C-241 respirator with TC-23C-81 organic vapor cartridge and C-241-7 filter. Approval Number TC-23C-110. Pulmosan Safety Equipment Corp.

Powered Air Purifying Respirators

-- 3MW262 and W263 powered air purifying respirators with W2114 cartridge and W2031 filter. Approval Number TC-23C-78. 3M Co.

Gas Masks

-- MSA Clearview or Ultraview Chin Style Gas Mask Systems with Pesticide Approved Canister (Numbers 448983, 448984, 448985, and 448986). Canister alone is 448972. Approval Number TC-14G-86. Mine Safety Appliances Co.

Hazards to Livestock

Currently approved pesticides used on or in the proximity of domestic animals generally fall into the class of compounds known as organophosphates. These compounds are potentially dangerous to animals, although when used according to label directions will not create problems. Organophosphate poisoning is usually a result of one or more of the following conditions:

a. Overdosage -- Recommended dosages vary with formulation. Be absolutely certain that the species and age of animals treated are consistent with the recommended use of the compound applied.

b. Concurrent use of two or more compounds that may overlap in their toxic effect on the animal -- For example, an animal should not be sprayed with Ciodrin while receiving an orally administered systemic pesticide such as Baymix.

c. Use of an organophosphate pesticide on an animal recently treated with a tranquilizer.

d. Accidental consumption or exposure due to improper storage of chemicals.

In case of accidental pesticide poisoning the following information may be useful to the attending veterinarian for reference purposes. Organophosphates are cholinesterase inhibitors. Acetylcholine is produced by some nerve fibers and plays a part in the transmission of nerve impulses to muscles. Cholinesterase is an enzyme important to the maintenance of proper acetylcholine levels. When a

cholinesterase inhibitor such as one of the organophosphates is present in excess, the symptoms seen will be those of acetylcholine toxicity. These include sweating, lacrimation, vomiting, cyanosis, muscle twitching, and, depending on the size of the toxic dose, coma and death.

The time of onset of these clinical signs depends on the size of the toxic dose of organophosphate and the route of administration, but usually falls within the range of one to twelve hours. However, repeated frequent exposure even at recommended dosages will cause a gradual depletion of cholinesterase to a point where a normal dose will cause clinical signs. This is more likely to be a problem for the human commercial applicator and people using these compounds should have their cholinesterase levels checked periodically.

Another group of pesticides, carbamates such as Sevin and Baytex, causes toxicity in the same manner as organophosphates but the clinical signs are not usually as severe. Although not generally cleared for use on animals these compounds may be used as residual wall sprays and are commonly used on crops so accidental poisoning may occur.

Atropine given intravenously is a specific antidote for both organophosphate and carbamate poisoning. The following is a dosage guide:

Cattle	0.5 - 1.0 mg/kg
Horses	0.1 - 0.2 mg/kg

This is a guide only and the dose should be repeated as often as every ten minutes until symptoms subside. In ruminants the effects of atropine last somewhat longer but in all species a mild degree of atropinization may be required until all absorption of pesticide has ceased. Where the toxicity is the result of dermal absorption, the animal should be decontaminated by thorough washing with soap and water.

In cases of severe organophosphate poisoning the use of atropine may be supplemented with pralidoxime (2 PAM, Protopamchloride), but this must not be used for carbamate poisoning. This drug must be administered soon after poisoning for maximum effectiveness.

Hazards to the Environment

Insecticides applied in or around dairy barns will also be carried into fields in manure and may end up in run-off waters. Since organophosphorous

compounds now recommended for use on or around dairy cattle are classified as non-persistent, that is they have half lives not exceeding two weeks, there is little likelihood that they will accumulate to toxic levels. On the other hand, persistent compounds such as lindane may remain in soils for longer than six months. The potential for toxic accumulations to develop in soils or animal tissues, or for contamination of ground water to occur is, obviously, much greater with compounds of this nature. Direct contamination of surface waters with any pesticide, including non-persistent organophosphates, should be avoided under all circumstances. Fish and other aquatic organisms such as insects and crustaceans are very susceptible to low levels of organophosphorous insecticides. Contamination of surface waters with sprays, immediate barn effluent, or materials drained from sprayers may well result in fish kills or damage to other aquatic organisms. Birds too are susceptible to insecticides, and in particular to compounds commonly used as residual wall sprays.

Here are some tips that you may follow to improve your operation and cut down on local contamination.

a. If you have a truck or trucks that service your sprayers, how do you carry your pesticides and other supplies? Rather than riding loose in the back of the truck they should be enclosed. Built-in lockers are convenient if you can get them, but a locked storage chest will be adequate.

b. You also need a place to hold those empty containers that you don't burn in the field.

c. A first aid kit in the cab of the truck can be a life saver. Plastic eyewash bottles that have a flushing action can also be carried in the cab.

d. A container of clean water fastened somewhere on the outside of the truck with detergent and hand cleaner nearby is also worthwhile for washing off spills, splashes or other skin contamination. A faucet or valve on the container will make it easy to control water flow.

If you transport pesticides over the highway you may accidently spill concentrates on the higway. Keep a shovel, stiff broom, and neutralizers (Clorox, lime) on your truck. Don't forget to call local police and health officials if the spill is too large for you to handle safely yourself. You should have boots, gloves and a respirator handy if the pesticide you are

carrying and applying is toxic enough to require them. This same equipment can also be used for spills of concentrated pesticides in the field.

Are you filling from a well? Who else is using it and for what purpose? Use a separate pump with check valves to prevent back siphonage and be sure the filler hose does not dip into the sprayer tank. If you mount the right size hook to hold the filler hose, you won't have to hold it and there will be no chance of its dipping into the tank. Remember that back siphoning can occur even in pressure water systems if there is a sudden heavy drain on the system. Be sure your sprayer doesn't overflow and drain pesticide contaminated water back into the well. If the well you are using is the source of domestic water or for watering cattle, you may want to fill elsewhere. Even if you fill elsewhere, you should take the same precautions (cattle drink from ponds and fish live in streams).

Suppose you do contaminate the well. What then? First, contact your county or state health official. Usually your actions will depend somewhat on the toxicity of the pesticide involved and how tightly it fastens to particles in the water and on the walls of the well. With materials of low or moderate toxicity, the well should be pumped dry, allowed to recover and pumped again. Addition of a charcoal slurry will help absorb the pesticide. Clorox or other chlorine compounds may help break down the pesticide. The well should be pumped dry after the addition of any of these absorbents or neutralizers. Domestic and barn plumbing should be thoroughly flushed after the well is decontaminated and before any water is used. If the contamination was of highly toxic materials, a chemical test should be made before the water is used. If the well cannot be purified you may be liable for a new water supply. Prevention of contamination may be vital to your business.

Your sprayer filling station can be designed to minimize problems. Frequently filling stations are on pond or stream banks and the natural flow is back into the water. Grading the area to slope away from the water will prevent this problem and allow you to neutralize an unplanned spill so that it does no damage. The other common problem with these areas is "empty" pesticide containers. Much too often they end up in the water. A trailer, old truck van or some other storage place, in which used containers can be held safely for disposal, will prevent this contamination.

Back at your storage and clean-up area there are two main possibilities for contamination: chemically contaminated runoff from wash water or fire fighting water and exposure to yourself or other people. Your core manual

tells you how to avoid runoff problems. The right precautions will help you avoid exposing yourself during clean-up or repairs. Dress properly for clean-up as well as for mixing or application. The residue that you scrub off the outside of your equipment may be more concentrated and toxic than the spray itself. Don't scrub the surface with your bare hands or a rag which will soon be loaded with the chemical. Instead use a scrubbing brush with a handle and, if necessary, rubber gloves. Check the label if you are in doubt.

Normally, you will not get inside your spray tank. However, you may have to make repairs that require you to do so. If so, remember that it is probably a highly toxic area. Avoid working alone. Wear full protective gear to prevent both dermal and inhalation toxicity. Even outside the tank welding may generate highly toxic fumes. Use a respirator.

Personal contamination or poisoning can also be caused by lying on contaminated ground while making repairs to machinery. Move the equipment to an uncontaminated area, or use a creeper, piece of linoleum or something similar to protect yourself.

As in other areas of pesticide handling, the best preventative for contamination is your own awareness and good judgement.

Insecticide Registration for Livestock and Poultry

Before an insecticide can be registered for use around animals, information as to how long it persists after application (residue), how it breaks down, and if it accumulates in the tissues of treated animals must be developed. Further, safe levels for human consumption in animal products (tolerance) must also be established. Without this information an insecticide cannot be labeled for use around animals or on forage crops that may be used as animal feeds.

Because certain insecticides do accumulate or persist in milk, meat, or eggs, any formulations used on or around lactating cows, beef cattle or swine and poultry will have specific recommendations concerning the number of days that must pass before cows freshen and beef or swine are slaughtered. Since eggs are processed daily, insecticides that produce residues that exceed tolerances are not registered for use on layer hens. A similar situation exists with milk and for this reason many insecticides that are alright for use on beef cattle, dry cows or heifers cannot be used on lactating cows. For example, concentrated insecticides used as "pour on", "spot on" or injectable treatments for cattle grubs, and certain whole body sprays for lice or mange

control, cannot be used on milk cows. Further, these compounds generally have restrictions concerning days to slaughter for beef or swine and days to freshening for heifers and dry cows. Use restrictions of this nature are clearly stated on the label of all pesticides used around animals or poultry. Following these guidelines will insure that if you apply the proper dosage, illegal pesticide residues will not result. Failure to comply with these recommendations can result in meat, milk or eggs being confiscated and responsible individuals subject to civil or criminal penalty.

NOTE: You may have to read the fine print! Any use restrictions concerning days to freshening, days to slaughter, or other animal handling concerns will be clearly stated on the pesticide label. The pesticide label on the following page lists this information under "use precautions" and "spray recommendations".

KORLAN* 24E

LIVESTOCK REMEDY... NOT FOR HUMAN USE

CAUTION—COMBUSTIBLE MIXTURE

N.Y.F.D. C. of A. No. 1136

CAUTION

KEEP OUT OF REACH OF CHILDREN
INJURIOUS TO THE EYES • IRRITATING TO THE SKIN • HARMFUL IF SWALLOWED
COMBUSTIBLE

Do not get in the eyes • Avoid contact with the skin

Avoid prolonged breathing of spray mists

Avoid contamination of food, feedstuffs, and water supplies

Keep material out of reach of animals

Keep away from heat and open flame

Keep container closed • Wash thoroughly with soap and water after handling

NOTE TO PHYSICIAN: This material is a cholinesterase inhibitor. Treat symptomatically. Atropine is an antidote.

USE PRECAUTIONS

Do not spray sheep and goats within 28 days of slaughter.

Do not spray beef cattle with ¾% Ronnel within 14 days of slaughter.

Do not spray beef cattle with ½% Ronnel within 7 days of slaughter.

Beef cattle may be sprayed with ¼% Ronnel any time prior to slaughter.

Backrubber may be used any time on beef or dairy cattle.

Do not use spray on animals producing milk for human consumption.

Dairy cows should be treated early in their dry period.

Do not spray dairy animals with ¾% Ronnel for 14 days prior to freshening. If dairy cows or heifers freshen within 14 days of the last spray treatment, milk must not be used for food for the required 14 days after the last spray treatment with ¾% Ronnel.

Do not spray dairy animals with ¼% or ½% Ronnel for 7 days prior to freshening. If dairy cows or heifers freshen within 7 days of the last spray treatment, milk must not be used for food for the required 7 days after the last spray treatment with ¼% or ½% Ronnel.

Remove lactating dairy animals from buildings while applying residual fly sprays.

Do not allow insecticide to come in contact with food, feed or water supplies.

This product is toxic to fish. Keep out of lakes, streams or ponds. Do not contaminate water by cleaning of equipment or disposal of wastes. Apply this product only as specified on this label. Do not apply where runoff is likely to occur.

Do not use containers, sprayers, and other equipment used for mixing and applying herbicides or insecticides to crops or pastures to mix or apply KORLAN 24E to livestock.

Do not reuse empty container. Destroy it by perforating or crushing it. Bury or discard it in a safe place away from water supplies.

WARNING: Ronnel is a cholinesterase inhibitor. Do not use this product on animals simultaneously or within a few days before or after treatment with or exposure to cholinesterase inhibiting drugs, pesticides or chemicals. Treatment with excessive dosages of organophosphates may lead to the general symptoms of muscular weakness, diarrhea, and excessive salivation. At the first sign of adverse reaction, consult a veterinarian. Atropine is an antidote.

NOTICE: Seller warrants that the product conforms to its chemical description and is reasonably fit for the purposes stated on the label when used in accordance with directions under normal conditions of use, but neither this warranty nor any other warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE express or implied extends to the use of this product contrary to label instructions or under abnormal conditions, or under conditions not reasonably foreseeable to seller, and buyer assumes the risk of any such use.

BACKRUBBER RECOMMENDATIONS

Cattle Backrubber – For hornflies. Aids in the control of lice if used continuously. Aids in the control of face flies if backrubber is placed so animals can rub face. Place where animals regularly travel or congregate.

Mix 1 gallon KORLAN 24E with 27 gallons diesel or mineral oil. Saturate fibre. Recharge as necessary. Do not mix with used motor oil.

SPRAY RECOMMENDATIONS

PROBLEM	Dosage (%)	Amount KORLAN 24E for 1 gal	25 gal	100 gal	REMARKS
LIVESTOCK INSECTS					
Cattle and Calves Hornflies, ear ticks and screwworms	½%	2½ oz	2 qt	2 gal	Dilute with water only. Spray entire animal to wet thoroughly. Retreat as necessary but not more often than every 2 weeks. For ear ticks, spray ears and surrounding area thoroughly.
Lice	¼%	1¼ oz	1 qt	1 gal	
Lone Star and Winter Ticks	¾%	4 oz	3 qt	3 gal	
Sheep, Goats, Lambs and Kids Hornflies, screwworms and fleeceworms	½%	2½ oz	2 qt	2 gal	
Lice and sheep keds	¼%	1¼ oz	1 qt	1 gal	
Hogs: Lice	¼%	1¼ oz	1 qt	1 gal	
RESIDUAL FLY SPRAY – A ½% spray will give about 2 weeks control. A 1% spray will give 4-6 weeks control					Spray walls, ceilings, partitions to obtain complete coverage with no runoff. Use 1 gallon of diluted spray per 500-1000 sq. ft.
Farm Buildings – Poultry houses, livestock shelters, milk rooms, dairy and hog barns	½% or 1%	2½ oz or 5⅓ oz	2 qt or 1 gal	2 gal or 4 gal	Add 3 ounces of sugar per gallon for added effectiveness. To prevent contamination keep milk and milking equipment covered while spraying. Do not spray directly on birds.
Meat, poultry, and other food processing plants, refuse areas and containers	1%	5⅓ oz	1 gal	4 gal	Do not apply in edible products areas of food processing plants.
Restaurants, and supermarkets (Outside area)	½% or 1%	2½ oz or 5⅓ oz	2 qt or 1 gal	2 gal or 4 gal	Spray outside walls, receiving docks, doorways and refuse areas.
Dwellings – Outside areas, including porches, patios, and garages	½% or 1%	2½ oz or 5⅓ oz	2 qt or 1 gal	2 gal or 4 gal	Spray to point of runoff.
Caged layers – on wire	2%	10⅔ oz	2 gal	8 gal	Spray poultry droppings beneath cages.
FLY BAIT – Where flies congregate, floors, windows, and doorways	2%	10⅔ oz	2 gal	8 gal	Add 3 ounces of sugar per gallon diluted spray. Spray or sprinkle at 1 to 2 day intervals until control is obtained. Do not use in food handling or food processing areas.
DARKLING BEETLES in poultry houses	½%	2½ oz	2 qt	2 gal	Spray floors, footings, and lower 2 ft. of inside walls of poultry houses. Use 2 gal of spray per 100 sq. ft. of area. Allow spray to dry before birds are placed on litter. Re-treat as necessary but remove birds from area until spray is dry.
COCKROACH CONTROL – Use 1% spray for German roaches, 2% for others					Apply as a spot spray to all areas frequented by cockroaches.
Buildings – Dwellings, institutions and food handling establishments	1% or 2%	5⅓ oz or 10⅔ oz	1 gal or 2 gal	4 gal or 8 gal	Apply as a spot spray to all areas frequented by cockroaches. Do not use in edible product areas or in serving areas while food is exposed.
Food Processing Plants	1% or 2%	5⅓ oz or 10⅔ oz	1 gal or 2 gal	4 gal or 8 gal	Do not apply in the edible products areas of food processing plants.
Meat Packing and Poultry Processing Plants	2%	10⅔ oz	2 gal	8 gal	Do not apply in edible products areas of food processing plants or other areas where food is commercially prepared or processed.
MISCELLANEOUS INSECTS – **Fleas and spiders** in buildings, laundry trucks, and dog kennels	1%	5⅓ oz	1 gal	4 gal	Apply 1 gallon of dilute spray per 1000 sq. ft. Spray floors, walls, cracks, crevices, sleeping quarters of pets, etc., where insects breed and harbor. Do not use in food handling or food processing areas.
Bedbugs in buildings and sleeping quarters, on beds and bedding	1%	5⅓ oz	1 gal	4 gal	Spray mattress and bedding lightly, including seams and folds, cracks and crevices in bed frames, walls, baseboards, and floors. Allow bedding and mattress to dry before using.
Fleas in lawns and kennel runs	1%	5⅓ oz	1 gal	4 gal	Spray infested areas. Keep children off treated area until spray has dried.
Ants, crickets, mosquitoes and silverfish	1%	5⅓ oz	1 gal	4 gal	Spray directly on insects where possible. Spray surfaces where insects alight, breed, or congregate such as under sinks and drainboards, in cabinets, and around baseboards, door sills and frames, window frames, garages, and outbuildings. Re-treat as necessary.
Chinch Bugs in lawns (Florida only) Retreat as necessary.					Apply following a good rain or a drench with ½ to 1 inch of water.
Thin Turf or Thick Turf (thatch and organic matter 1½ inch thick or more)	0.15%	0.8 oz	20 oz	80 oz	Dilute with water only. Use 25 gallons diluted spray per 1250 sq. ft. For thick turf, repeat in two weeks if necessary.

II. PESTICIDE APPLICATION EQUIPMENT

The equipment used by commercial applicators in the Agricultural (Animal) Category is usually of three general types. These are:

Sprayers

-- High pressure hydraulic sprayers - skid mounted, trailer mounted

-- Low pressure sprayers - tractor mounted or smaller pumping units

Mist Application Equipment

-- Hand-held with electric motors. Occasionally larger mist blowers are used

Dipping Vats

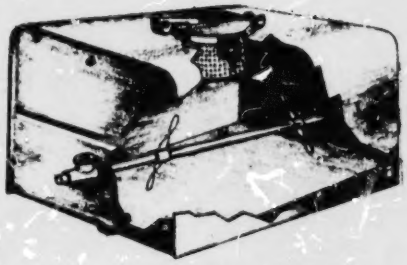
-- Usually trailer mounted

Whatever the problem you are treating for your equipment must deliver the right amount of pesticide. This is particularly important when making an application directly to an animal because overdosing can result in injury to the animal. You can determine the delivery rate of your equipment and time the application so that the right amount of pesticide is applied, for instance when using mist application equipment either for directed animal sprays or space sprays. You can spray to the point of run-off as is done when applying residual flysprays to walls. Or you can completely soak the animal as you do when dipping or making a dilute high pressure mange application. In all cases the pesticides must be properly weighed or measured and mixed so that recommended concentrations will be used. When making direct applications to animals you should figure the total amount of spray needed for the herd or flock and then check back to be sure that you are applying the right average amount per animal. Of course this is a good idea when making any pesticide application.

Components of Agricultural-Animal Equipment

The tank is a major component of a sprayer. It should be large enough to avoid the need for too frequent refilling which is time-wasting and inconvenient. Stainless steel and fiberglass are considered to be the best tank materials because of their corrosion resistance. While more expensive than some other materials, the different in cost is not great when averaged over the many years

of service that a corrosion resistant tank will give. These tanks are also advantageous in that they can be easily and well rinsed. When treating animals or premises used for producing meat or milk it is especially important that materials previously used in the tank do not contaminate the spray mix being used. If the spray mix is contaminated, illegal residues in meat or milk may result and the product will be unsaleable. For the same reason, it is always advisable to flush out hoses before starting work.



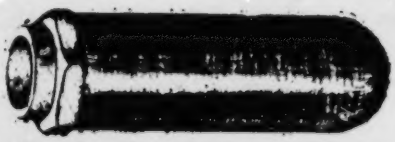
Agitators

The need for agitation depends on the type of chemicals applied. Emulsions such as Ciodrin residual spray require little agitation, but wettable powder suspensions require vigorous agitation to prevent settling out. Tanks with square corners require better agitation than tanks with rounded shapes.

There are two methods of agitating the spray material in the tank. Mechanical agitation, the most positive method, is provided by paddles or propeller. Hydraulic agitation is provided by the return flow of excess spray material from the pump. When hydraulic agitation is used to suspend wettable powders, as might be the case when using a low pressure sprayer, a simple by-pass line from the relief valve is not enough. There should be a separate agitator line from the pressure side of the pump to the bottom of the tank.

Strainers

Strainers are used to prevent scale, rust flakes and other foreign material from plugging the nozzle or other working parts of your sprayer. They may be installed as necessary on the pressure line or may be purchased as a part of the nozzle and should also be placed on the intake line.



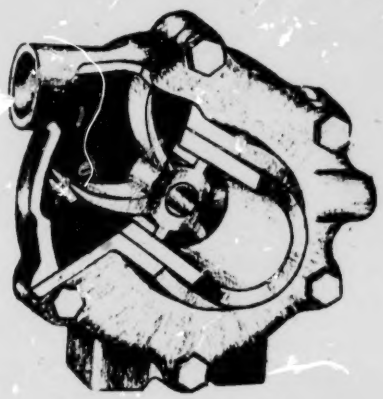
Pumps

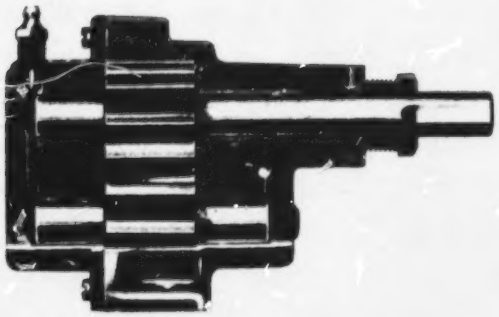
A good spray pump must deliver the required pressure and the required volume within its normal working capacity so it is not constantly working at

its limit. If abrasive materials are used it must be able to pump them over a long period of time without much loss of performance. The metal parts must be resistant to corrosion if corrosive materials are to be used. You must choose gaskets, plunger cups and impellers that are resistant to swelling or chemical breakdown when using most liquid pesticides. If wettable powders are used the pump must be abrasion resistant.

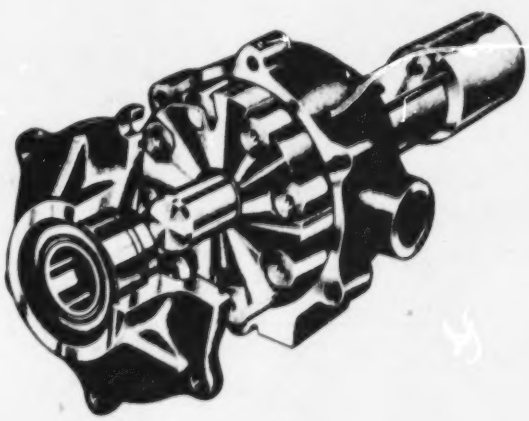
Never operate a sprayer pump at speeds or pressures above those recommended by the manufacturer. The pump will usually take this stress for a short time, but will soon break down or wear out. Never run pumps dry since they depend on the spray liquid for lubrication. Some spraying applications require only simple economical pumps. Generally speaking, as your pressure and volume requirements increase, the cost and complexity of a satisfactory pump also increases.

Centrifugal sprayer pumps use an impeller to give high volumes at low pressures, although two stage centrifugal pumps now used on some orchard and vegetable sprayers develop pressures in excess of 200 psi. The power requirement is relatively low and the operating speed is relatively high. They are the only sprayer pumps in general use that are not positive displacement pumps so pressure regulators or release valves are not essential. Pressure depends on RPM of the pumps. Because the impeller does not contact the pump housing, most centrifugal pumps are satisfactory for pumping abrasive mixtures such as wettable powder suspensions even when they are concentrated. Centrifugal pumps are not self priming so they must be mounted below the tank outlet or a priming system must be built in. They are relatively cheap, but are entirely satisfactory for many types of application. These pumps are frequently found on commercial spray-dippers that are used by regulatory agencies in treating quarantinable diseases.





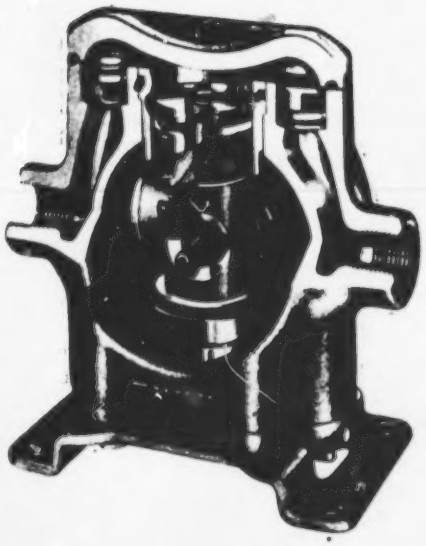
Gear pumps are simple, low priced positive displacement pumps that are used on agricultural sprayers for operating pressures of up to 100 pounds. They are satisfactory for pumping liquids or emulsions, but wear rapidly if suspensions are used. They are self priming when in good condition, but may lose that ability when worn. Depending on size, they deliver low to moderate volumes of liquid. They are not affected by solvents since all the parts are metal. Some are cast iron with stainless steel impellers; others are bronze so they will resist corrosion. They are commonly used on mist blowers and boom sprayers. Their power requirement is more than for centrifugal pumps, but is still relatively low. When a gear pump becomes worn it usually cannot be satisfactorily rebuilt.



Roller pumps are commonly used on low pressure sprayers. They are positive displacement self priming pumps with a slightly higher power requirement than gear pumps. They are also generally more costly but still relatively inexpensive. The rollers, made of nylon or rubber, are more abrasion resistant than the gears in gear pumps and can be replaced when worn or swollen. However, suspensions will wear the rest of the pump out after awhile. Roller pumps are capable of higher pressures than the gear pumps that are used on sprayers but sustained operation at maximum pressures will often cause the seals to blow out.

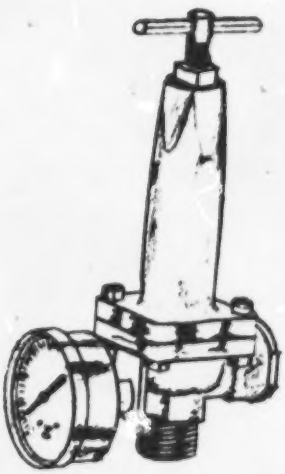
Well made piston pumps are probably the most reliable of the commonly used sprayer pumps. They are heavily built and the larger ones are capable of pressures of 600 lbs/sq. in. or more. They deliver moderate to high volume depending on the

pump capacity. The better quality pumps have replaceable plunger cups made of leather, neoprene or nylon fabric so they are abrasion resistant, easily rebuilt and capable of handling wettable powder suspensions year after year. The power requirement is higher than the other pumps. For low pressure sprayers a piston pump is not usually needed, but they are excellent where higher pressures are required or where both low and high pressures are needed.



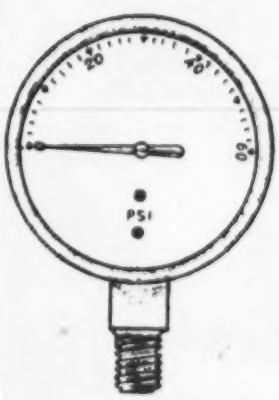
Pressure Regulators

A pressure regulator is one of the most important parts of a sprayer. The pressure regulator controls the pressure and therefore the quantity of spray material delivered by the nozzles. It protects pump seals, hoses, and other sprayer parts from damage due to excessive pressure and by-passes the excess spray material back to the tank. When selecting a pressure regulator, be certain that the flow capacity of the regulator matches that of the pump being used.



Pressure Gauge

A pressure gauge is essential on any sprayer. Without one, the operator cannot tell how the sprayer is functioning. If the pressure does not remain constant, the amount of liquid coming out of the nozzles will vary. The gauge should always be mounted so that the operator can see it easily. Pressure gauges often wear out soon because they become clogged with solid particles of spray material. A glycerine loaded diaphragm type gauge is more expensive, but will last indefinitely.



Hoses

There are four main points to consider in selecting sprayer hoses:

1) Composition (chief liner material)
2) Construction (reinforcement, rigidity or flexibility)
3) Working pressure
4) Size

High quality hoses and fittings are expensive but economical when used over a long period of time. The hose liner should be resistant to chemical action of the spray materials. The working pressure of the hose should be equal to the maximum pressure the pump delivers. If the hose is too small (inside diameter) the sprayer will not operate properly. If the hose in the suction line is too small the pump will starve. If the hose in the pressure line is too small there will be excessive pressure and drop in volume.

Commercial Equipment Used in Agricultural-Animal Category

Sprayers

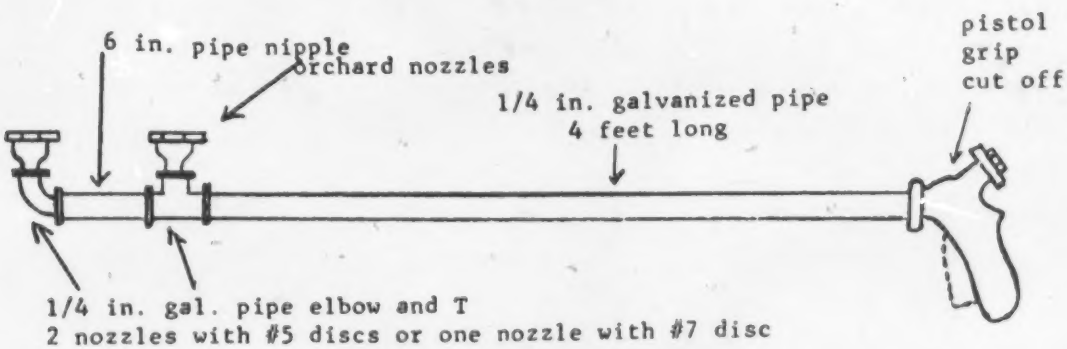
High pressure hydraulic sprayers have many uses around animals. Their high pressures result in the good penetration into fur and wool that is necessary for control of lice, mange, wool maggots, etc. The same high pressure is required to adequately disinfect livestock or poultry housing. With a single outlet gun the high pressure sprayer is useful for treating loosely confined animals in pens, paddocks or other loose housing. When adjusted to lower pressures the sprayer can be used for applying residual sprays to walls and other surfaces for fly control. The sprayer can also be used for applying pesticides to walls and floors of farm granaries. There are many other uses in the agricultural plant or ornamentals categories for these versatile sprayers, so if the commercial applicator is certified in other categories he will find the high pressure sprayer of even more use. Usually these sprayers have piston pumps and mechanical agitators and are solidly built, long lasting machines. They are commonly skid mounted to be carried in trucks, trailer mounted or, less commonly, carried by tractors on a 3-point hitch.

Usually high pressure hose and a hand held spray gun are used with the hydraulic sprayer. The type of gun used varies with the type of spraying to be done.

In New York State the Bureau of Animal Industry has established minimum specifications for hydraulic sprayers used in skin parasite control programs as follows:

Tank Capacity	150 gallons, preferably more
Pump Capacity	7 to 10 gallons per minute
Pressure	350 to 400 pounds
Motor	Water or air cooled unless power take-off is used
Tank	Must be equipped with agitator

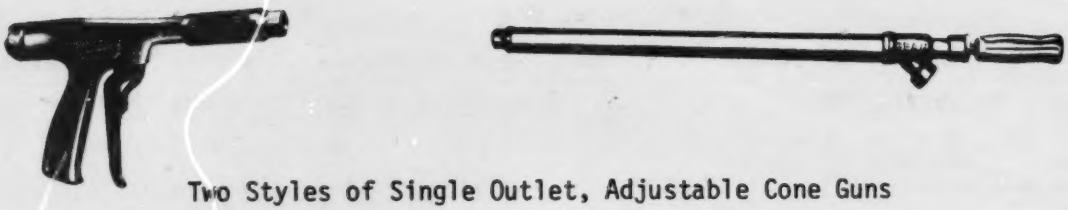
Specifications for the gun and nozzles are illustrated. If the older style potato spray nozzles are not available, cone type nozzles that deliver



High Pressure Mange and Louse Gun

about 1.25 gallons per nozzle per minute at 400 pounds pressure may be substituted. Using this type of gun the applicator can stand in the aisle behind the cow and reach up under the belly, around the brisket and forelegs, between the udder and hind legs and can thoroughly soak these and other hard to get at areas. The spray direction is always near right angles to the body portion being treated, so the spray drives into the skin rather than bouncing off the hair.

The single outlet, adjustable cone spraygun is not suitable for spraying stanchioned cattle, since the operator cannot usually obtain the desired nozzle position at right angles to the cow; therefore the spray hits at a flattened angle and much of it bounces off rather than penetrating.

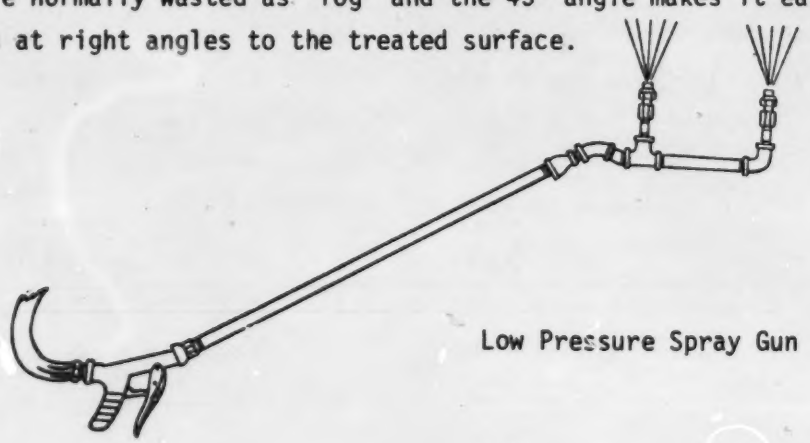


Two Styles of Single Outlet, Adjustable Cone Guns

These adjustable single outlet guns are useful for spraying loose housed animals or animals that are confined in large pens out of doors. By adjusting the spray pattern to a solid stream one can reach out 20 to 30 feet with the spray pattern and with practice can control the movement of the animals with the spray gun. A rectangular holding area is best. Animals are crowded into one end of the pen, then worked one by one to the other end with the spray. This treats one side of the animal. The animals are then worked back to the other end of the pen, thus treating the other side of the animal. This cycle is repeated three or four times until the animals are thoroughly wet. This method is not acceptable for sarcoptic mange, but is suitable for louse, grub and chorioptic ("barn itch") mange.

When using either method at least two gallons of spray per mature cow should be applied. This type of gun is also useful when disinfecting livestock or poultry premises.

When using the high pressure hydraulic sprayer to apply residual pesticides to control flies or for granary insects you should reduce the pressure to 80 - 125 lbs then spray to the point of run-off walls, ceilings, support posts, and other areas over which the insects will walk or hide. The spray gun recommended is equipped with flat fan weed nozzles mounted at a 45° angle as shown in the illustration. The lower pressure reduces the number of fine droplets produced that are normally wasted as "fog" and the 45° angle makes it easy to hold the nozzles at right angles to the treated surface.



Low Pressure Spray Gun

Low pressure sprayers are not as versatile as high pressure sprayers in treating animals and animal premises. They do not give the penetration and force needed to control many pests. They may also be slower than high pressure sprayers and therefore not efficient for commercial applicators. However, a low pressure unit is satisfactory for applying residual fly sprays, for granary pests, for manure larvaciding, for fowl mite and for other animal uses not requiring high pressures. If your principal work is with crops or some other category requiring low pressure equipment you may wish to use this equipment for occasional animal pesticide applications. Likewise if you work only in one phase of the Agricultural-Animal category such as applying residual fly sprays, low pressure equipment may be sufficient. Most tractor mounted sprayers or engine powered pumping units will be satisfactory for low pressure pesticide application provided nozzles or guns designed for lower pressures are used.

Mist Application Equipment

There are some hand-held electrically powered mist "foggers" that are satisfactory for both space applications of insecticides and for application of sprays directly to the animal. These are not to be confused with the thermal foggers that generate an insecticidal smoke by heating the spray mixture.

The bottom part of a mist fogger is usually the spray tank that holds 1 to 1-1/2 gallons of spray mixture. An electric motor is mounted above the tank. The motor drives a fan which produces an airblast that sucks the spray mixture up from the tank, shears it into a fine insecticidal mist, and projects the mist for several feet.

These machines are used both as space sprayers and for treating animals by many private applicators. However, the commercial applicator will use them primarily in louse and chorioptic mange (barn itch) control. Some mist foggers are better adapted than others for treating animals. Those having single spray outlets and a relatively narrow and strong airblast are preferred. They should produce a coarse mist and project a horizontal airblast 15 to 20 feet. They should also deliver 4 to 5 gallons of spray mixture per hour, using the largest outlet or maximum setting available.

The delivery rate of the mist fogger must be known in order to determine the time required to apply the recommended amount of pesticide to the animal. Dosage to the animal depends upon the amount of time the spray mist is directed

toward it. If the mist fogger delivers 4 gallons per hour at its maximum delivery rate, it will take about 7 seconds to deliver 1 fluid ounce of spray. This is figured in the following manner:

1 gallon = 4 quarts = 128 fluid ounces of spray

Multiply 128 by the pumping rate of 4 gallons per hour

4 x 128 = 512 fluid ounces per hour

Divide 512 by 60 minutes to find the rate per minute

512 ÷ 60 - 8.5 fluid ounces per minute

Divide 8.5 by 60 seconds to find the rate per second

8.5 ÷ 60 = .14 fluid ounces per second

If you multiply .14 by 7 seconds the answer is .98 ounces or about 1 ounce in 7 seconds. Therefore in order to apply 3 to 3.5 ounces of spray usually recommended for louse control, it would take about 20 to 25 seconds to spray the animal. To adequately cover the whole animal in this amount of time requires practice. You must time yourself or have some one time you until you become proficient at counting the elapsed seconds. As with most other types of spray application it is wise to treat a number of animals, for instance 10, and then check the amount of spray used to be sure you are applying the right amount.

Dipping Vats

Commercial applicators may occasionally use portable dipping vats for external parasites of sheep or swine and regulatory people may use spray dipping machines in treating quarantinable infestations.

Portable dipping vats are usually trailer mounted tanks with a system of folding ramps and railings that can be trailed from farm to farm. The animals to be treated are driven up the ramp onto a platform, spun around if possible and pushed into the tank, upside down if possible. In righting themselves they are completely immersed. If it is impossible to put the animal upside down, the head must be pushed under the surface. Dipping vats are slow, tiring to operate and require several people, but coverage of the target animals is complete when they are properly handled.

Spray-dip machines are trailer mounted chutes through which livestock is driven, often with difficulty. Several banks of large nozzles are mounted within the chute and are supplied with spray mixture from a sump under the chute. A large centrifugal pump is used to supply the nozzles and surplus and runoff spray falls back into the sump, is filtered and recirculated to the nozzles. Doors at either end of the chute hold the animal until it is thoroughly covered with spray.

III. PESTS - LIVESTOCK AND POULTRY

You can't solve a pest problem if you don't know the pest. Knowledge of what the pest looks like, when and where it is found, and what damage it may cause, is essential to providing effective control. When you have this information you may decide to do nothing because it is too late in the season, or because effective chemical control methods are not available. On the other hand, available evidence may indicate that chemical control can reduce the problem and that proper use of a pesticide is both safe and appropriate for the situation.

Apart from mosquito-born encephalitis of horses, insects and mites associated with livestock and poultry in the northeast seldom carry disease causing agents. Many of these species do, however, induce other effects harmful to animal production and health. Reduction of milk or egg production, decreased weight gains, hide downgrading, and self-inflicted injury are common responses to insect and mite activity. The following information is presented to provide you with an understanding of the identification and biology of insects and mites associated with livestock and poultry in the northeast that you may be called on to treat. There are other livestock and poultry pests of economic importance that will not be discussed in this manual since you as a commercial applicator will not usually be asked to apply controls for them. Such pests include sheep keds, mosquitoes, black flies, bot flies, etc. Current chemical control methods are also discussed.

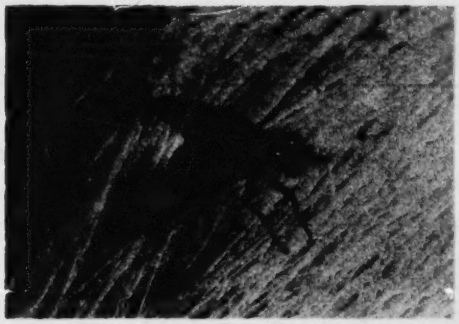
House Flies, Stable Flies and Face Flies

Description: Adult house flies have stout greyish colored bodies about 1/4 inch in length and have one pair of clear unmarked wings. House flies are most numerous around areas where animals are kept, especially during the summer months. Here they are commonly seen resting on posts, walls, ceilings around lights, or searching for food from various organic sources. The biting stable fly is similar in size, shape and color, and also commonly

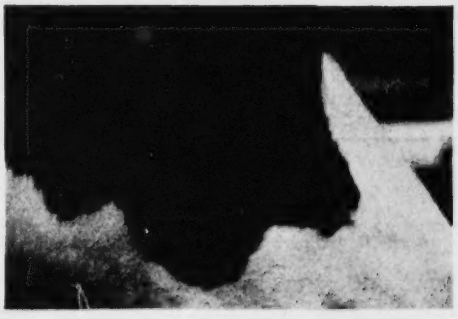
House Fly

rests on posts and walls. Unlike the house fly, however, and in keeping with its blood feeding habit, the mouthparts of the stable fly project straight out in front of the head. Another species similar in appearance to the house fly, but usually seen only out in the pasture on animals is the face fly.

Life Cycle: It is not by chance that house flies are most common during the summer months and around areas where animals are kept. Immature house fly larvae or maggots breed in decomposing manure and develop most rapidly at summer temperatures. Moist poultry manure and the manure-straw pack that often accumulates in calf pens is also highly favorable for house fly breeding. House fly maggots hatch from eggs laid by female flies and pass through three developmental stages during a 3 to 5 day period. After this phase of development they change into an oval-shaped reddish brown pupa. The adult fly develops within the pupa and emerges after about one week. At summer temperatures a complete house fly life cycle may be completed in 7 - 10 days. This rapid development accounts for the great increase in house fly numbers that occur if breeding sites are available during warm weather. The life cycle of the stable fly is similar, but takes twice as long and the maggots are most commonly found in urine soaked straw and straw mixed with manure. Spilled green chop will also support stable fly development. The face fly breeds only in freshly voided cow manure deposited in pasture locations.



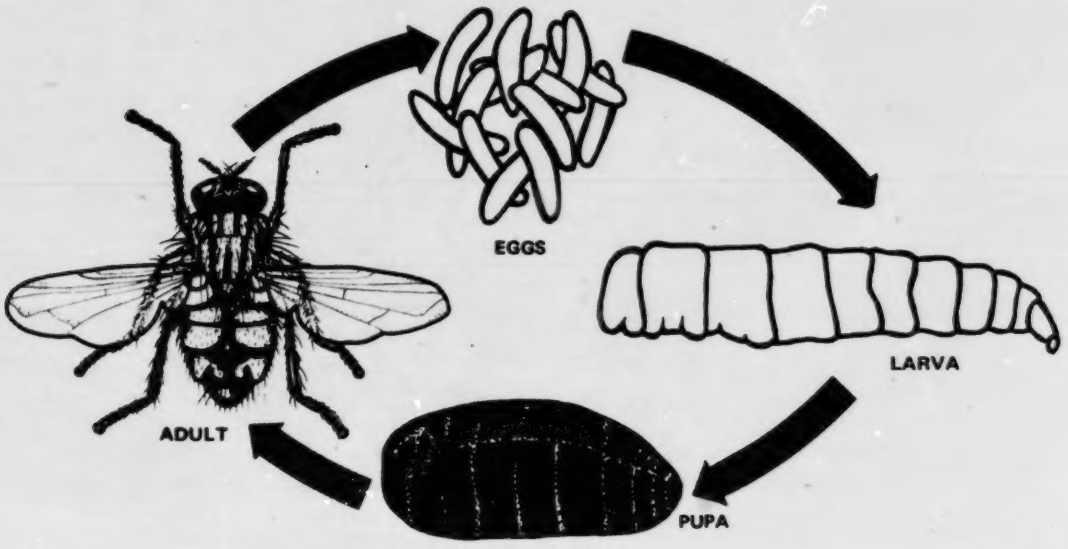
Stable Fly



Face Fly

Damage: In their quest for food, house flies commonly fly from manure on other rotting organic materials to food, cold drink cans, eating or milking utensils, or uncollected eggs. Since house flies may carry harmful bacteria on their feet and mouthparts and often deposit drops of vomit or feces that may also be contaminated, high fly populations are a threat to safe egg or milk production. This relationship is commonly recognized by state sanitary codes that call for keeping houseflies out of the milkroom. High fly populations in barns or chicken houses are also a bothersome nuisance and make even a simple task very unpleasant. Further, dried fly specks are difficult to remove unless each egg is washed individually and contaminated eggs may be downgraded.

House Flies on Wall



House Fly Life Cycle

Control: With the development during World War II of chemicals that would remain active long after application, treating the inside of dairy barns with low pressure residual wall sprays became an effective and popular method for controlling house flies. Residual wall sprays are still used in many areas, but the ability of the house fly to survive what were once lethal treatments, a phenomenon known as resistance, and restrictions on use for compounds with extended persistence, has reduced the attractiveness of this method. In some areas of the Northeast, house flies can now withstand from 10 to 100 times the concentration of compounds that were effective a decade ago. Where resistance to commonly used insecticides exists, alternative compounds with differing chemical structures may be effective. Remember that not all compounds with labels for house fly control can be used as residual sprays inside dairy barns. Check the insecticide label to be certain that a particular compound is safe for use around lactating cows.

House Flies in Barn

Residual sprays are most effective when applied to surfaces that flies commonly frequent. In addition to posts, stanchions, and walls, all overhead beams, rafters or ceilings should be treated. House flies often congregate on overhead resting sites during the cooler nighttime hours, especially in pole barns or sheds. Surfaces treated should be sprayed to the point of run-off. Any excess spray will only be wasted and represent a potential source of contamination. Remember that all cattle or swine must be out of the barn before spraying, and all drinking cups and milking utensils covered. Do not apply residual sprays in the milkroom and avoid exposing hay bales or other feed sources. Only mist sprays containing 1% or less pyrethrins plus synergist, or Vapona pest strips, one per 1000 cubic feet, can be used in milk rooms.

Residual wall sprays are also a useful method for controlling house flies in poultry houses. Note that certain insecticides are recommended for use with birds in the house, others only after all birds have been removed, and others are not to be used around poultry under any circumstances. Check label precautions carefully before application of residual sprays to poultry houses. Spray treatment of manure under caged birds to kill house fly maggots (manure larviciding) can also be an effective control method. As compared to residual wall sprays, however, manure treatment requires heavier dosages and more frequent applications.

The preparation of chemicals for residual wall sprays or manure larvicides involves only the mixing of emulsifiable concentrates or wettable powders in water. Depending upon the compound selected for use, one or two gallons of chemical concentrate to 50 gallons of water will give the 1% spray solution generally recommended. Most residual wall sprays are applied at the rate of one gallon per 500 ft. of surface area, but always check the label to be certain. The following formula can be used to determine the amount of chemical that will be needed to mix with water to make a 1% solution for spraying a particular barn.

Example 1.

To prepare a spray of a certain percentage from a wettable powder (WP) use:

$$\frac{\text{gallons of spray needed} \times \text{\% of spray recommended} \times 8.3^{*}}{\text{\% of wettable powder}}$$

* one gallon of water weighs about 8.3 lbs.

Problem:

Assume that 40 gallons of 1% spray is needed from a 50% Rabon WP.

$$\frac{40 \text{ gallons} \times 1\% \times 8.3}{50\% \text{ WP}} = \frac{332}{50} = 6.6$$

Therefore, to make up 40 gallons of a 1% solution you will need 6.6 lbs. of Rabon 50% WP.

Example 2.

To prepare a spray of certain percentage strength from an emulsifiable concentrate (EC) use:

$$\frac{\text{gallons spray needed} \times \% \text{ spray recommended} \times 8.3}{\text{lbs. active ingredient per gallon in EC*} \times 100}$$

Problem:

Assume that 40 gallons of 1% spray is needed from 25% Cygon EC (2 lbs. active ingredient per gallon)

$$\frac{40 \times 1 \times 8.3}{2 \times 100} = \frac{332}{200} = 1.66$$

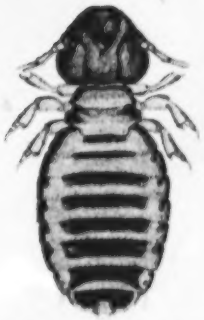
Therefore, to make up 40 gallons of 1% Cygon solution, add 1.66 gallons of 25% Cygon 25% EC to 40 gallons of water.

---

* check the label of each can for this information

Lice

Description and damage: Lice are small, up to about 1/8" long, wingless insects with large legs and claws for clinging to hair or feathers, and live only near the skin of warm blooded animals. Cattle, swine and horses are commonly parasitized by lice, but rodents and fowl have lice too. Lice from one animal species such as cattle will not survive if transferred to other animals such as swine or horses. Lice are grouped as either sucking or biting depending on how they feed. Sucking lice feed upon the host's blood and tissue fluids, whereas biting lice usually feed only on skin fragments and debris. Lice can be found by parting the hair or feathers of suspect hosts and looking carefully for small (next page)



Little Red Cattle Louse
(a biting louse)

Little Blue Cattle
Louse

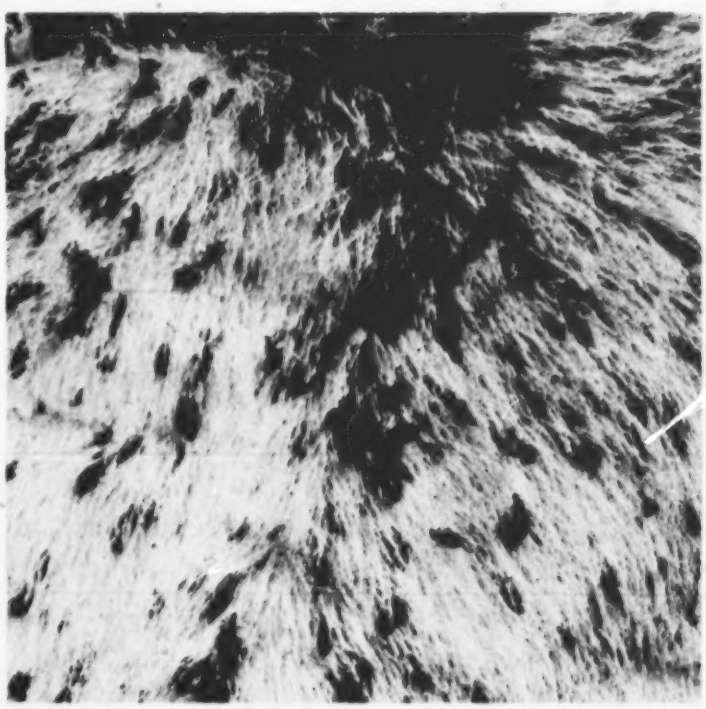
Long-nosed Cattle Louse

Short-nosed Cattle Louse

(These three species are sucking lice. Sizes of the four species as illustrated above are roughly proportional to each other. The largest louse, the short-nosed cattle louse is about 1/8 inch long).

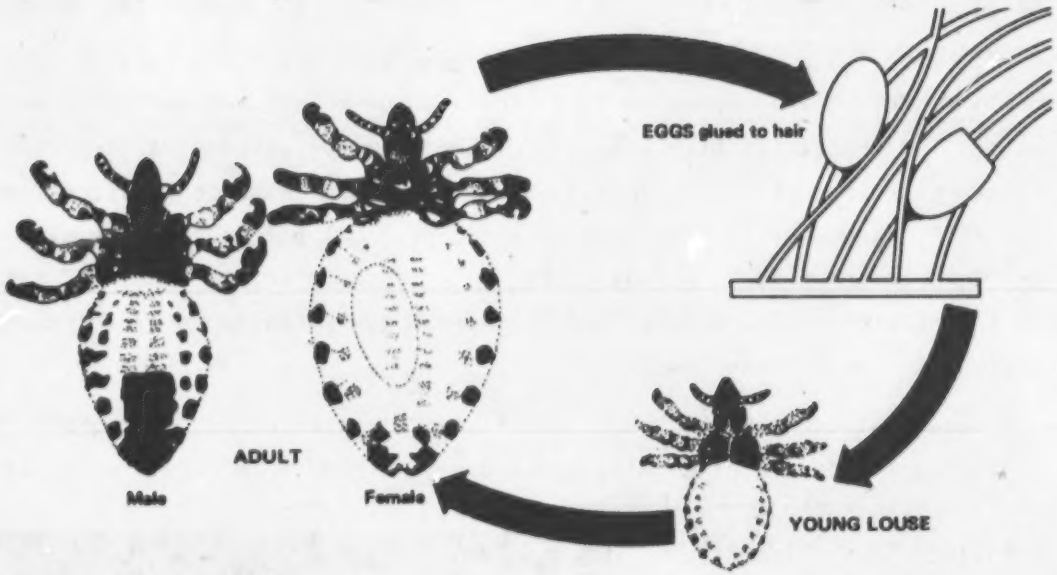
reddish, yellowish, or bluish forms near the skin. Hair pull samples taken along the back midline or hip bone hollows of cattle will often give an indication of louse numbers. In low infestations, none to few lice will be seen, but in heavy infestations the hair will contain accumulations of lice, eggs, egg cases and cast louse skins. Cows with heavy infestations often have shaggy uneven hair coats and rub and itch infested areas frequently. One biting louse and up to three sucking louse species are found on dairy and beef cows in the Northeast. Swine host only a single sucking louse, but poultry may be infested with several species of both types. Modern caged hen management has virtually eliminated louse infestations of laying hens.

Life Cycle: The entire life cycle of all louse species takes place only on host animals. Louse eggs are attached near the base of host hairs or feathers, and upon hatching produce the first of three nymphal



Sucking Louse Infestation

Sucking Louse Infestation



Life Cycle: Sucking Louse

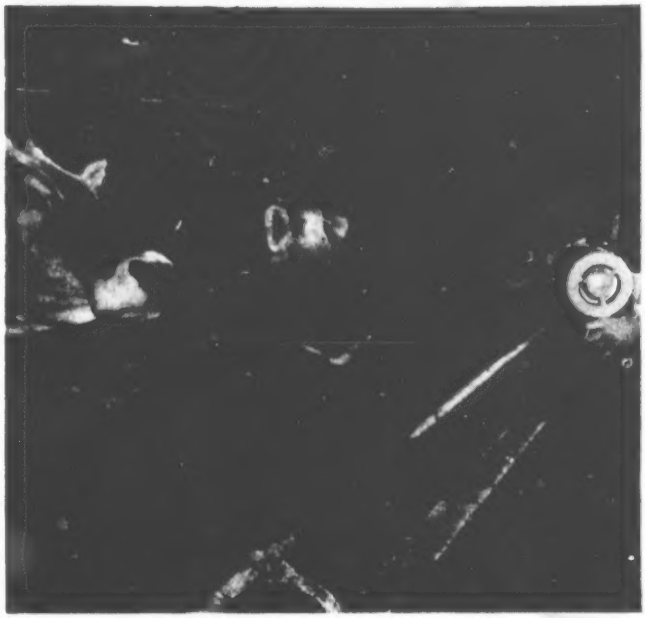
or immature stages. Immature lice, although smaller, are similar to adults in appearance and behavior and are found in the same areas on the host. Under favorable conditions the life cycle of cattle lice takes about 30 days. Lice on cattle are usually most numerous in the winter months. The lack of direct sunlight, long winter hair coat and inability of stanchioned cows to groom favor rapid louse population buildup. The poll, dewlap, back midline, axillae of legs, and base of tail regions are favored areas of infestation. Cows in free stall or tie stall barns generally have fewer lice than cows in stanchion barns, but even under these conditions lice may become very numerous. It is not uncommon for a few cows to have high numbers of lice and to serve as carrier hosts from which other cows are infested. Calves usually get lice from their mothers.

Control: The best time to treat for cattle lice is in the fall just after cows come in from pasture. Killing the small numbers of lice that survive the summer will aid in preventing the buildup of large numbers later on. Further, the use of whole body spray treatments is a difficult task and stressful to

animals on subfreezing winter days. Louse populations generally decline without treatment when cows are put out to pasture in early summer. It is therefore generally unwise to treat for lice after the first of April, unless the host animals, either cattle or swine, are kept in the barn throughout the summer.

Effective louse control demands two treatments, the first to eliminate nymphs and adults, the second to kill lice from eggs laid before the first treatment. Conventional high volume whole body sprays using various organophosphate compounds at 1% concentrations are good for louse control treatments in the fall. Remember to check the insecticide label before treating milking cows. Certain compounds, including the systemic "pour on" or "spot on" treatments that are effective and labeled for use on non-lactating and beef cows, cannot be used on milking cows.

If you must treat milking cows for lice during the winter, our experience indicates that a concentrated mist applied with a hand-held electric fogger is an effective method, eliminating the difficulty of keeping the sprayer from freezing up and avoiding the chilling of treated cows. Because mist foggers apply insecticide in a concentrated form, however, it is important to calibrate the fogger carefully to avoid overdosing treated animals. To calibrate a fogger, first determine the maximum number of ounces of insecticide released per minute, and from this calculate the time in seconds necessary to apply the proper dosage. Most commercial foggers pump 4 to 5 gallons per hour so that 3 to 3-1/2 ounces, the usual dosage per cow, is discharged in 20 to 25 seconds. A thorough, but light, moistening of the hair over the entire body is adequate; two treatments 14 days apart are needed.



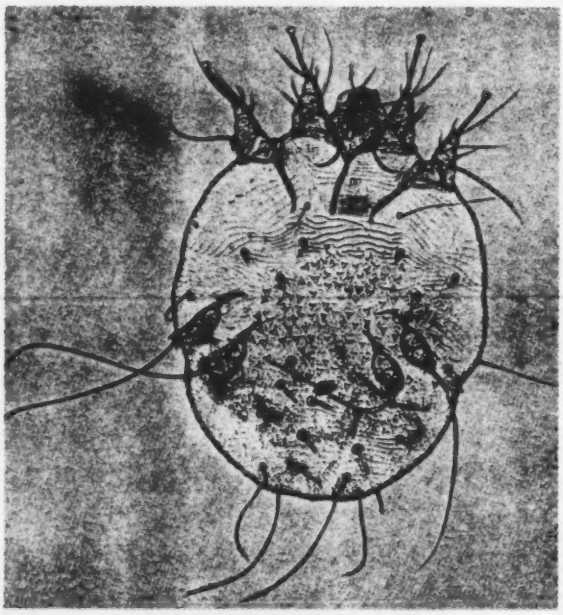
Electric Mist Fogger Application for Louse Control

Mange Mites

Parasitic mites, and in particular "scab" and "mange" mites, have in years past had a severe effect on livestock production in the Northeast. Infested animals frequently develop highly irritating lesions and are very contagious, spreading mites rapidly to uninfested animals. The severe itching and rubbing that accompany scab or mange infestations often lead to hide damage, reduction in milk, loss of weight, a weakened or emaciated condition, and even death. As the result of a rigorous herd quarantine and dipping program in the 1950's, the scab mite (Psoroptes) was eradicated from the northeast. However, both sarcoptic mange and chorioptic mange (barn itch) are still with us. In New York State cases of sarcoptic mange have become more numerous in recent years.

Sarcoptic mange

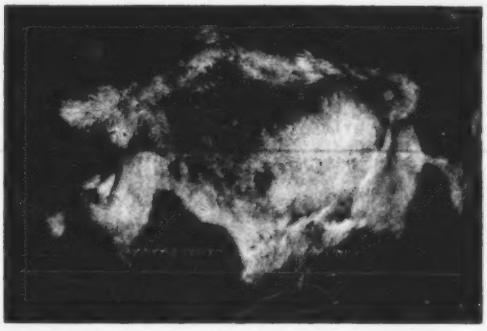
Description: Sarcoptic mange is caused by microscopic mites of the genus Sarcoptes. These mites burrow into the hosts' skin which produces irritation, and this in turn leads to the itching and rubbing of infested areas. Sarcoptes mites usually invade areas where the hair is short and thin. In cattle, the head, neck, brisket, and inner thighs (escutcheon) are commonly infested. In swine, the ears, base of tail, feet, and inside of legs are most commonly invaded. Sarcoptes mites from one type of animal will spread to other hosts, including man, but these infestations are short lived and usually self terminate. Acute inflammation, thickening of the skin, hair loss and crusty scabs are common signs of sarcoptic mange.



Sarcoptes Mite

Sarcoptic Mite and Eggs in Host Skin

Control: Because sarcoptic mange of cattle and swine is a very serious and highly contagious condition it is classified as a quarantinable disease. Animals with sarcoptic mange are therefore required by law to be reported to state veterinary officials. Upon confirmation of sarcoptic mange in a herd all animals will be quarantined against movement or sale until proper control procedures are carried out. Sarcoptic mange is difficult to control, and it is important to note that compounds now available for controlling lice and barn itch are not effective for controlling sarcoptic mange. Lindane is effective for treating sarcoptic mange, but because of its strong residual effect, is no longer registered for this use on lactating dairy animals. In New York State lindane may be used to treat sarcoptic mange of non-lactating cows and swine under a special use permit and under supervision by a state veterinarian only. The following information outlines the conditions whereby lindane can be used for treating sarcoptic mange in New York State. A review of procedures for treating lactating cows with hot lime and sulfur is also included.



Loss of Hair and Skin Lesions
Sarcoptic Mange

Diagnosis:

a. The diagnosis of sarcoptic mange is based upon:

1) A demonstration of Sarcoptes mites in skin scrapings

2) The presence of characteristic gross skin lesions

3) Rubbing and itching activity indicative of sarcoptic mite infestation.

b. Any diagnosis of sarcoptic mange will be verified by a specialist from the office of the New York State Veterinarian.

Arrangements for Treatment:

a. Upon confirmation of sarcoptic mange, the owner will be notified and a quarantine against stock sale or movement imposed.

b. The owner will agree to comply with specific terms for treatment of all animals in the herd.

c. The owner will make application for permit to purchase lindane (DEC form PR-106) -- Form B - Purchase Permit Application.

d. Approval by DEC of owner application for purchase of lindane.

Recommended Treatment:

a. Lindane may be used only for treating sarcoptic mange of non-milking cattle and swine, only when conducted by certified applicators using an approved hydraulic sprayer, and only under supervision of a representative from the office of the New York State Veterinarian.

b. Treatment will consist of two whole body applications of 0.06% lindane made at 10 day intervals.

1) Formulation: Lindane 0.06% solution can be made up from wettable powder by using 2 lbs. of 25% WP to 100 gallons water. With lindane emulsifiable concentrate (E-con) containing 1.7 lbs. of lindane per gallon, use 37.5 fluid ounces per 100 gallons; or .375 of a fluid ounce per gallon of water. With a lindane concentrate containing 1.5 lbs. lindane per gallon, use 42.5 fluid ounces per 100 gallons of water, or .425 of a fluid ounce per gallon.

2) Dosage: At least 2 gallons per treatment per cow, at least 1 gallon for young stock up to six months and swine, 1/2 gallon for small pigs.

c. Animals to be treated must be retained in such manner that every part of the external body surface can be exposed to a thorough drenching.

d. All treatments shall be conducted in an area where environmental contamination will be minimal. In particular:

   1) All feed, portable equipment and utensils should be removed from the treatment area

   2) Animals should be confined to a small area

   3) There must be no ditches, streams, or rivers nearby

   4) If a level area is not available, the perimeter of the treatment area should be built up with dirt and the area covered with hydrated lime to absorb runoff

   5) Treatment areas are not to be used for other purposes until properly cleaned and all runoff absorbed into the soil

e. All treated animals must be held for 30 days after the last treatment before being shipped or slaughtered. Milk from heifers or dry cows that freshen before 30 days after the last treatment, cannot be used for sale or mixed with other milk.

f. Prepared 0.06% lindane solution maintains its stability for at least 2 or 3 days. If frozen, the solution may be used, but it must be completely thawed. Lindane solution may be heated during cold weather months.

g. Calves under two months of age, emaciated animals with extensive skin lesions, or animals weakened from other causes, may become sick or die from lindane treatment. Use a lighter, but thorough, treatment for these animals.

h. Left over lindane spray solution may be applied to walls, partitions, stanchions, etc.; if the amount is not excessive, it can be placed in containers for use at the next spraying site. If there is too much material for either of these uses, excess solution may be sprayed on level land where livestock cannot come into contact with it before any liquid has been absorbed into the soil. Do not select an area near ditches, streams or rivers. Runoff from the treatment area, or lindane saturated lime, may be applied to the same area. All lindane

left in the purchased container after the second treatment must be reported in the "Livestock Spraying Report" (A1596) under "remarks".

i. There is little danger to humans involved in lindane treatment for sarcoptic mange, provided that the recommended dosage is applied, and that coveralls, rubber boots, and rubber gloves are worn. If ventilation is poor a respirator approved for pesticide use is suggested. A thorough washing with warm water and soap should follow spray treatment.

Treatment of Milking Cows With Hot Lime and Sulfur:

a. Milking cows should be treated with lime and sulfur in the usual dilution of 1 part lime-sulfur to 12 parts water, and heated.

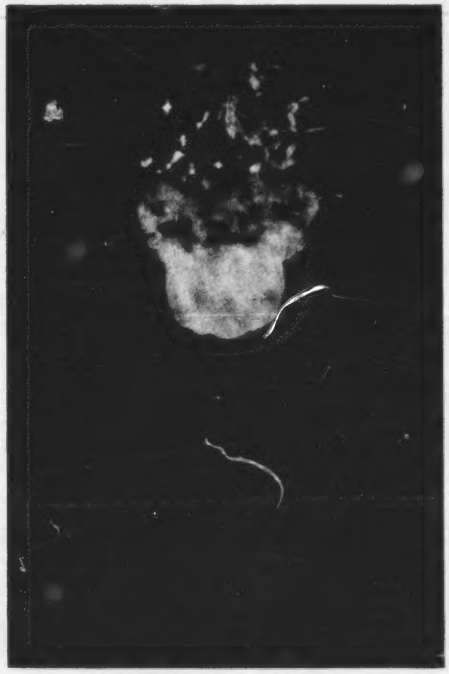
b. Treatments are to be made only by an approved applicator using an approved hydraulic sprayer.

c. Three treatments at 10 day intervals are required. Complete and thorough coverage of all host external surfaces is essential.

d. Treatments are to be made only under the supervision of a representative from the Office of the New York State Veterinarian.

Chorioptic Mange

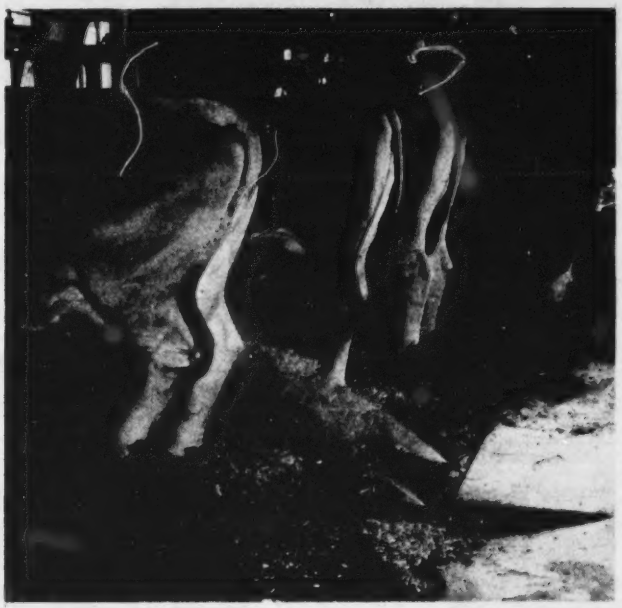
Description and damage: Chorioptic mange, or barn itch, is also caused by a microscopic mite. Unlike Sarcoptes mites, however, this mite lives on the skin surface and causes less of a problem. Many cows in a herd may be infested with chorioptic mites, but only certain individuals react to mite feeding and develop mange conditions. The hocks, hind legs, and escutcheon are most commonly affected, but infestations may also spread to the tailhead, back, flanks of hind legs or rib cage. Inflammed areas of skin devoid of hair, or



Chorioptes Mite

redness of skin on the hind legs and escutcheon are characteristic of cows reacting to chorioptic mites. Cows stanchioned during the winter seem to develop barn itch symptoms more commonly than those in free stall barns.

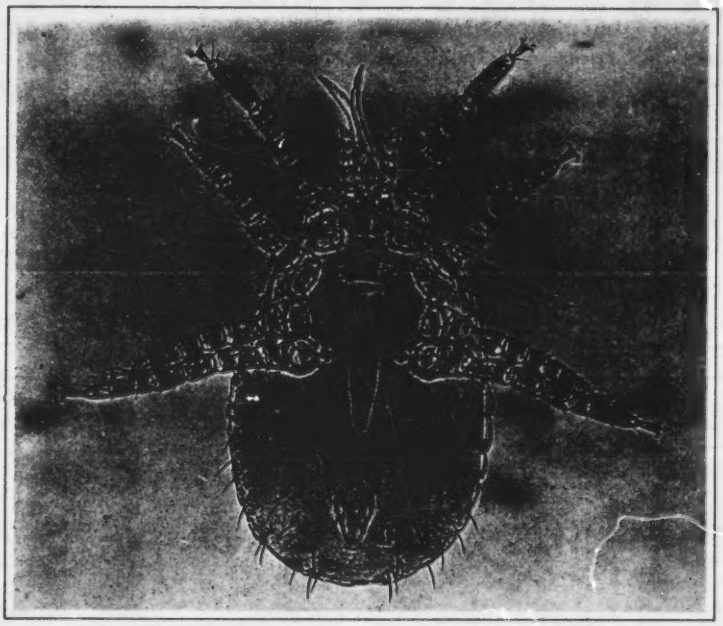
Control: Chorioptic mange may be effectively controlled by spray or mist fogger treatments, although only certain compounds are effective for this purpose. In treating chorioptic mange, it is particularly important to direct spray or mist applications to the lower hind legs, especially the hocks where this mite is most commonly found. Since certain compounds labeled for louse control on lactating cows can also be used for controlling this mite, it is often convenient to treat both parasites on the same occasion.



Spray Treatment for "Barn Itch" and Louse Control

Northern Fowl Mite

Description: Northern fowl mites are tiny, eight legged ectoparasites that live in the feathers of both domestic and wild birds. Individual mites are pin-head sized, often dark in color from ingested hosts' blood, and move rapidly when disturbed. Northern fowl mites are most common near the base of feathers surrounding the vent. At high population levels feathers in this

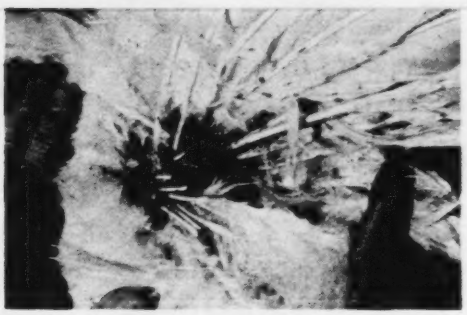


Northern Fowl Mite Adult

region commonly become matted with crusty masses of mites, cast skins, eggs and debris. At high population levels, mites will also spread to other areas of the body, the outside of feathers, and onto cages. The northern fowl mite is now very common throughout the Northeast and is our primary fowl ectoparasite problem. The poultry red mite, once a common poultry parasite, is usually found on roosts or in nest boxes rather than on the birds themselves, and is reddish in color. Modern caged hen poultry houses are seldom infested by this mite.

Life cycle: All life stages of the northern fowl mite are found on host birds. Female mites take blood from the host, and from this energy source develop mature eggs. Northern fowl mite eggs are attached to host feathers and hatch in less than a day, giving rise to 4 immature stages, two of which feed from the host, and two of which are resting periods. This sequence can take place in 4 or 5 days, which accounts for the rapid increase of mites that occurs under favorable conditions. Northern fowl mite populations usually reach highest levels during the winter months. This mite can survive for six weeks in the absence of host birds.

Damage: Northern fowl mites affect host birds in several ways. Low mite populations apparently have little effect on layer hen health, but high mite numbers can cause anemia (blood loss) and possibly result in decreased egg production. Whether northern fowl mite infestations actually reduce egg production is not clear. Some studies have shown reductions in egg numbers from infested hens, but in other studies using hens on a commercial high protein diet, no egg reduction response to mite infestation was observed. It is clear, however, that northern fowl mites, if

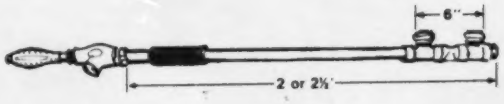


Northern Fowl Mite Infestation

uncontrolled, can develop to very large numbers, spread to cages, and to uncollected eggs. Mites crawling on eggs are not appreciated by egg sorters! On roosters, northern fowl mites are a more serious problem and can lead to the death of infested individuals.

Control: Northern fowl mite infestations of caged chickens can be controlled by chemical treatment. At least two effective and available compounds, applied as 0.5% sprays at 1 gallon per 100 birds, are labeled for this purpose. Nevertheless, difficulties in controlling the northern fowl mite are commonly experienced. This problem apparently stems from the failure of treatments to penetrate through the outer feathers to the feather base where mites are found. It is recommended, therefore, that one, or several, of the following procedures be followed in treating northern fowl mite infested chickens.

1) Spray applications should be directed at caged hens from under the cage. This will insure that the vent area is treated, and will improve spray penetration as the insecticide flow will be parallel to feathers rather than at a right angle to them.



A Spray Gun Suitable for Treating Northern Fowl Mite

2) Use 100 to 125 p.s.i. for spray treatments, particularly when it is difficult to get under birds.

3) Dilute recommended spray concentration by one half, and make two successive treatments.

4) Add one quart of detergent to 100 gallons of mixing water.

5) Use a spray gun with two nozzles set approximately 6" apart as shown in the illustration.

SUMMARY OF ARTHROPODS ASSOCIATED WITH LIVESTOCK AND POULTRY

Pest Species	Domestic Animal(s)	Effect Upon Host	Location Upon Host and/or Where Commonly Observed	Time of Year Most Numerous and Areas Where Immature Forms Found (If Important)
House Fly	Beef cattle Dairy cattle Swine Poultry	Nuisance to animals and animal handlers. Fly specks on eggs.	Widespread on animals and indoor quarters.	Summer months, maggots in manure or manure and feed or straw mat.
Stable Fly	Beef cattle Dairy cattle Swine	Nuisance due to blood feeding activity.	Commonly found on lower legs; flies rest on indoor and adjacent outdoor surfaces.	Summer months; often numerous in the fall. Maggots in urine soaked hay or straw and spilled feed.
Lice	Beef cattle Dairy cattle Swine	Irritation, itching, hair loss, unthriftiness.	Commonly along the dorsal body, around the ears, on the dewlap and legs.	Louse populations usually attain pest importance during winter months; will generally self-terminate in early summer. All stages on same areas of host.
Keds (ticks)[1/]	Sheep	Irritation, itching, wool loss, unthriftiness.	Trunk of body.	Largest numbers observed during cold weather months. Complete life cycle occurs on sheep.
Chorioptic Mites (Barn Itch)	Dairy cattle	Irritation, itching.	Lower hind legs and escutcheon.	Most common in winter months and on cows in stanchion barns.
Sarcoptic Mites	Dairy cattle Beef cattle Swine	Irritation, hair loss, extreme itching.	Neck, around ears, body trunk, and at base of tail.	A highly contagious, quarantinable disease; contact your state veterinarian. Usually most common during the winter months.
Northern Fowl Mite	Chickens	May result in decreased egg production.	Most numerous around vent area.	Mites can build up at any time, but usually most common during cooler months. All life stages remain on hosts.

1/ Information on sheep keds is included in the summary for your information, although they are usually treated by the flock owner.

ACKNOWLEDGEMENTS

This training manual for the study of insects and mites associated with livestock and poultry was developed cooperatively by Cornell University and the New York State Division of Animal Industry of the Department of Agriculture and Markets. Editors were R. F. Pendleton and E. T. Schmidtmann. Members of the committee were:

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Eastman Kodak Company (photograph - page 39)

These contributions are gratefully acknowledged.

The information given in this manual is supplied with the understanding no endorsement is implied and no discrimination is intended.

STUDY QUESTIONS

CATEGORY 1 - AGRICULTURAL PEST CONTROL

SUBCATEGORY - ANIMAL

1. Sarcoptic mange is similar to chorioptic mange (barn itch) in that:

		True	False
a.	both are caused by mites	____	____
b.	both are common on dairy animals but only certain animals react	____	____
c.	both are quarantinable diseases	____	____
d.	both are controlled by the same insecticides that control lice	____	____

2. Louse infested cattle often:

   a. fail to complete the lactation cycle

   b. develop shaggy, uneven hair coats and rub and itch

   c. become depressed, bloated and fail to eat

   d. are cured of the infestation when brought into the barn for the winter

3. Because sucking lice take blood from host animals they are:

   a. considered a quarantinable disease

   b. transmit several important diseases of dairy cows

   c. cannot be controlled by methods effective against biting lice

   d. create considerable irritation to host animals if present in any number

4. As compared to larvicide treatment of manure, residual wall spray treatments are:

   a. more expensive

   b. can only be applied with a mist fogger

   c. require fewer treatments

   d. seldom, if ever, are effective or recommended

5. Which of the following considerations are of primary importance when using insecticides on or around dairy cows?

   a. whether the insecticide is an EC or WP formulation

   b. whether there is a post treatment time interval that must elapse between treatment and the freshening of dry cows or heifers

   c. the rate and volume of compound to be applied per animal

   d. whether cows can be in the barn during treatment applications with space sprays or to walls, ceilings, posts and stanchions

6. Name four conditions under which pesticides registered for livestock use may still be hazardous to the animal.

   _____

   _____

   _____

   _____

7. To make a finished spray of 0.1% Ciodrin for use in a power sprayer as a whole animal spray to control lice and chorioptic mange, how many pints of 1.1 pound per gallon Ciodrin EC are used per 100 gallons of water?

   a. 3 pints

   b. 5 pints

   c. 4 pints

   d. 6 pints

8. A whole animal spray of 0.5% methoxychlor can be used on both lactating and beef cattle for the control of lice.

   a. True

   b. False

9. When treating for sarcoptic mange the applicator should apply at least _____ gallons per mature cow.

   a. .5

   b. 1

   c. 2

   d. 3

10. Sarcoptic mange in milking cows in New York State:

    a. must, with permit approval, be treated with 0.06% Lindane

    b. will result in the milk from infested cows being confiscated

    c. may, in most cases, be effectively treated by the same compounds used for controlling lice

    d. must, under supervision of a state veterinarian, be treated with hot-lime and sulfur

11. Sarcoptic mange of swine and cattle is considered to be a quarantinable disease because:

    a. mange is invariably fatal to animals

    b. mange can spread readily to other animals or herds if infested animals are moved about

    c. mange leads to contamination of milk products

    d. there is no known cure for this condition

12. The insect effectively controlled by residual wall sprays in dairy barns is the:

    a. horse fly

    b. house fly

    c. cattle grub

    d. face fly

13. Residual wall spray treatments inside dairy barns may be less effective today than in years past because:

    a. there are more flies today

    b. the face fly was introduced in the mid-1950's and has become more numerous

    c. residual sprays cannot now be used in milkroom

    d. resistance to residual insecticides exists in house fly populations

14. Often, a primary source of house fly breeding in dairy barns is:

    a. the straw and manure pack accumulated in calf pens

    b. milking waste water

    c. freshly voided manure from cows feeding at bunkers

    d. fresh, dry bedding material

15. Give 5 precautions to observe when applying a residual spray of 1% Cygon to a dairy barn.

_____

_____

_____

_____

_____

16. The residual Cygon EC spray emulsion should be applied to interior barn surfaces at the rate of 1 gallon to approximately:

    a. 100 square feet

    b. 250 square feet

    c. 500 square feet

    d. 750 square feet

17. Which one of the following chemical formulations can be used inside milkrooms?

    a. Vapona Pest Strips

    b. residual ronnel spray

    c. Vapona bait

    d. Vapona mist spray

18. Using the formula: $\frac{\text{gallons of spray needed X \% spray recommended X 8.3}}{\text{\% wettable powder}}$

    how much of a 25% WP would you need to make up one hundred gallons of a 1% suspension?

    a. 6.6 lbs WP

    b. 13.2 lbs WP

    c. 26.4 lbs WP

    d. 33.2 lbs WP

19. High house fly populations in poultry houses are a problem because:

    a. they cannot be treated because of toxicity to birds and residues in eggs

    b. chickens will eat too many flies

    c. they are a nuisance to egg handlers and others in the house

    d. all, or none, of the above

20. Northern fowl mite infestations of caged layer hens are sometimes difficult to control because:

    a. insecticides toxic to this mite are not available

    b. hens cannot be effectively treated because of possible residues in eggs

    c. the problem is usually not diagnosed in time

    d. this mite lives close to the skin and is therefore often protected from exposure to insecticides by the feather coat

21. Replacement cartridges for respirators approved for use in pesticide application will be marked with the code number _____ following TC

    a. 20L

    b. OK

    c. the date of manufacture

    c. 23C

22. Tolerances for levels of insecticide residue that may occur in meat, milk or eggs, must be established before an insecticide can be used on animals or fowl entering commerce.

    a. True

    b. False

23. Poisoning may occur if an animal is treated with two or more compounds that overlap in their toxic effect.

    a. True

    b. False

24. Sweating is common sign of pesticide overdosage in domestic animals.

    a. True

    b. False

25. Generally, insects and arthropods common to the Northeast are seldom involved in transmitting disease causing agents to livestock or poultry.

    a. True

    b. False

STUDY QUESTIONS

CATEGORY 1 - AGRICULTURAL PEST CONTROL

SUBCATEGORY - ANIMAL

ANSWER SHEET

1. a - True
   b - False
   c - False
   d - False

2. b

3. d

4. c

5. b,c,d

6. a. Overdosage
   b. Concurrent use of compounds that may overlap in toxic effect
   c. Use of organophosphate pesticides on tranquilized animals
   d. Accidental consumption or exposure

7. b

8. False

9. c

10. d

11. b

12. b

13. d

14. a

15. a. Wear respirator and protective clothing
    b. All animals must be out of the barn.
    c. Avoid contamination of feed, water, milking utensils. Cover, then clean mangers and drinking cups.
    d. Do not spray in the milkhouse.
    e. Do not spray styrofoam surfaces.

16. c

17. a

18. d

19. c

20. d

21. d

22. True

23. True

24. True

25. True